The United States Measurement System

Roadmapping America's Measurement Needs for a Stronger Innovation Infrastructure

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September 22, 2005

NIST
National Institute of Standards and Technology
Technology Administration
U.S. Department of Commerce

Takeaways

What is the USMS?

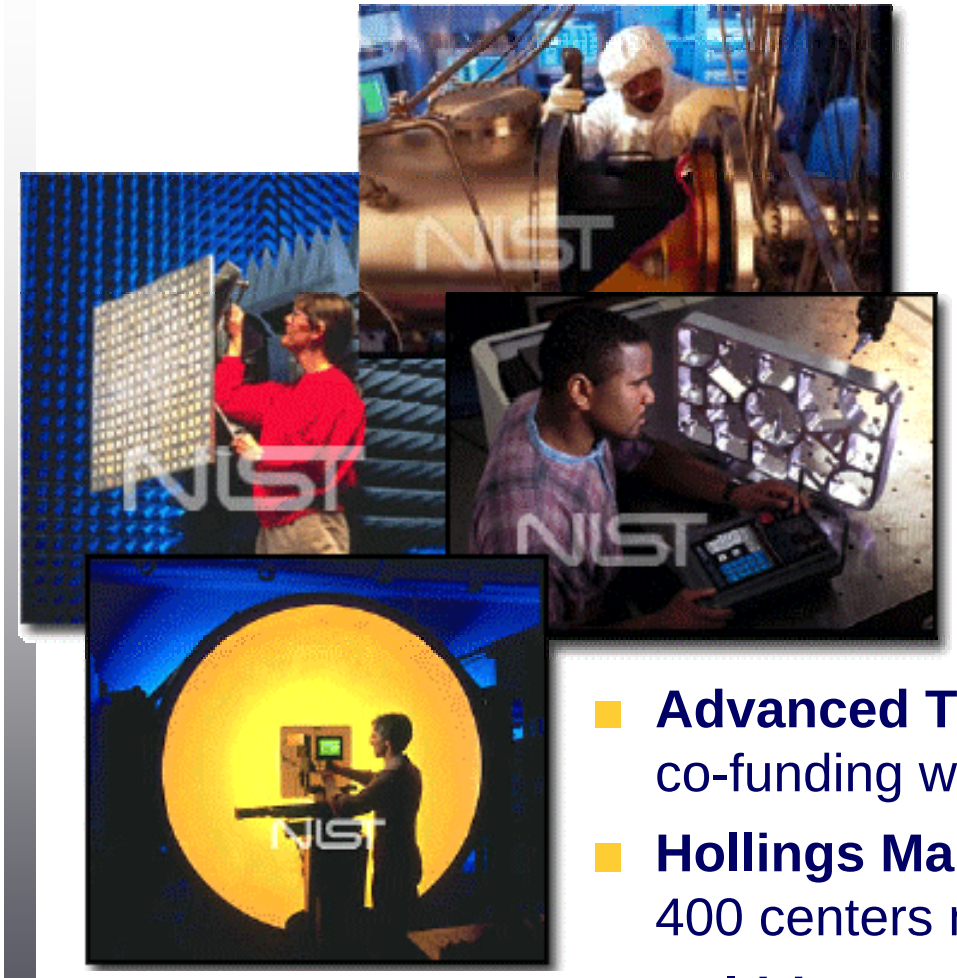
- The USMS is vital to an innovation economy
- The USMS assessment is a long-term task

How to Help?

- Help specify your industry's needs
- Prioritize needs
- Identify current or potential solution providers

NIST's Mission …

Develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life.

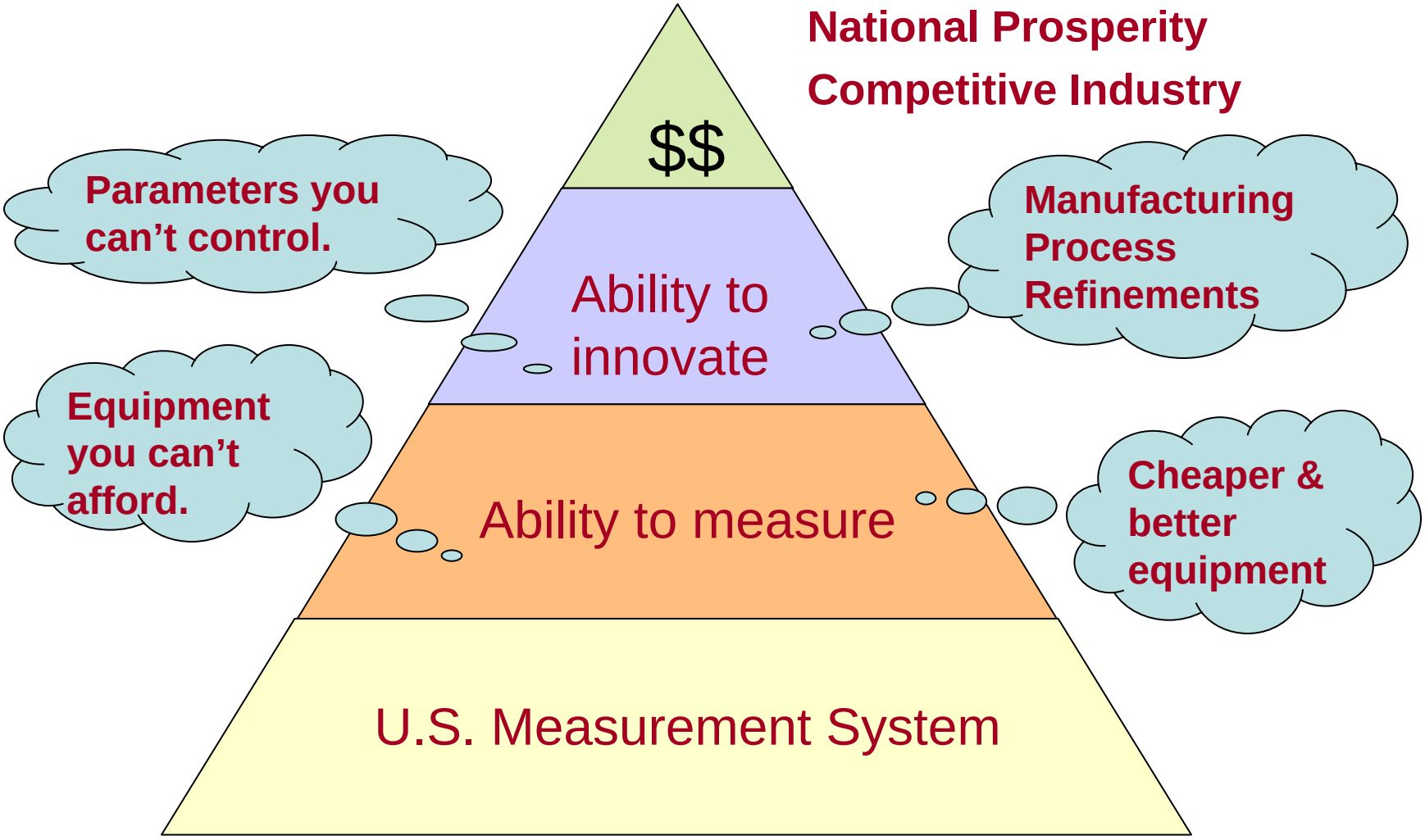


NIST assets include:

- $771 million FY 2004 operating budget
- 3,000 employees
- 1,800 associates
- **NIST laboratories**: National measurement standards

- **Advanced Technology Program**: $2,269 million co-funding with industry since 1990
- **Hollings Manufacturing Extension Partnership**: 400 centers nationwide to help small manufacturers
- **Baldrige National Quality Award**

Why measurements?



Innovation in the news …

"Innovation will be the single most important factor in determining America's success through the 21st century."

Report of the "National Innovation Initiative"
Council on Competitiveness
December 2004

"We conclude that although the United States still leads the world in research and discovery, our advantage is eroding rapidly as other countries commit significant resources to enhance their own innovative capabilities."

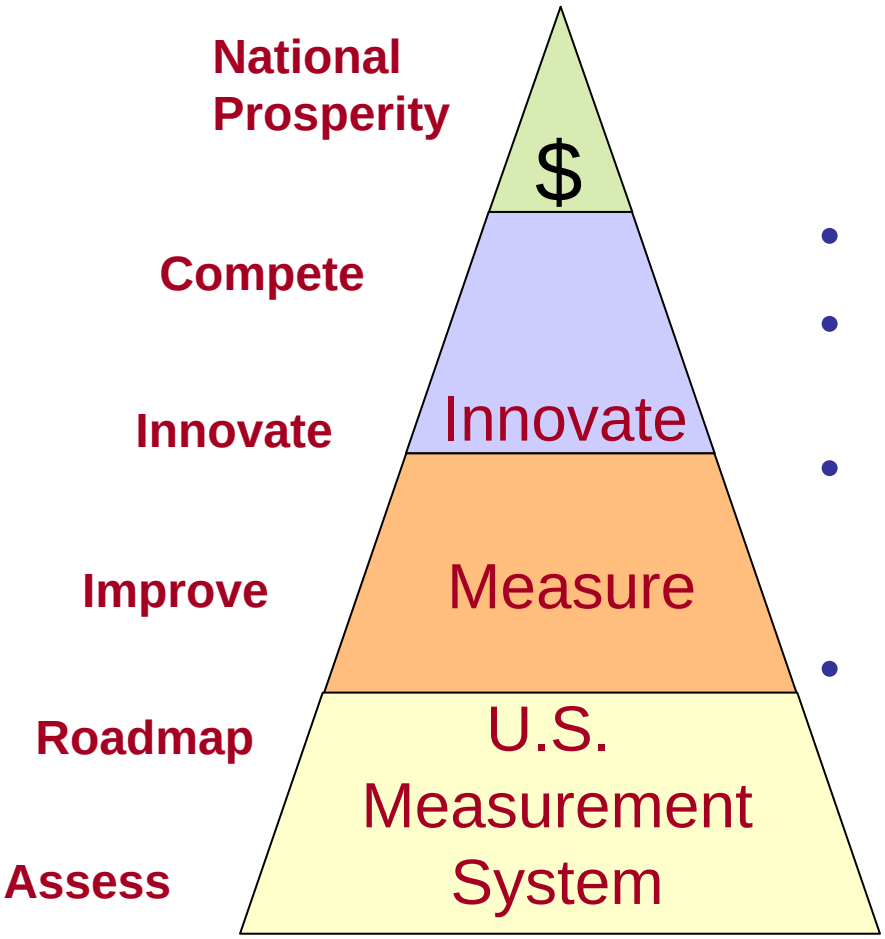
Task Force on the Future of American Innovation
February 2005

Innovation in the news …

"… we live in a competitive world ... We shouldn't take our preeminence as the world's greatest economy for granted. We've constantly got to make sure the economic environment here is strong. We've got to make sure that we're innovative."

President G.W. Bush
April 2004

The Solution…



- Systematically evaluate the USMS, identifying gaps in metrology, standards and infrastructure
- Deliberately seek solutions
- Proactively enable emerging technologies with new metrology
- Continue the refinement to ensure completeness and accuracy
- The complete assessment process will take many years and will be updated indefinitely

Workshop Goals:

1. Capture the most important measurement and standards (M&S) related needs facing your industry.
2. Agree with your colleagues on which M&S challenges are most important to pursue. Recommend solution providers.
3. Begin a systematic and ongoing dialog and consultation process related to your M&S needs.
4. Begin to reduce available M&S technology as impediments to technical advancement.
5. Increase American efficiency and quality.
6. Working together, we can take steps to protect and enhance American competitiveness.

Please Help Identify

- What do you need to measure (in detail)?
  - Metrology science/technology?
  - Metrology standard practices
  - Consensus Standards
  - System infrastructure (e.g., training)
- How important is this measurement issue?
- How is it solved today?
- Who provides this solution?
    - Are you satisfied with the solution?
    - What further work needs to be done?

The USMS

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www.nist.gov/usms

Comments or Questions?

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USMS Assessment and Roadmapping Process

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What is the USMS?

- The U.S. Measurement System is the complex of all methods, instruments, entities, institutions, and standards involved in *measurements* of products and processes of significance to the economy, security, and quality of life of the Nation.

The Problem…

- No system-wide understanding:
  - "Health" of the measurement system is unknown
  - Reactive metrology solutions from NIST and others
  - Industry innovates very expensive, ad-hoc and single use metrology solutions! All cost $$
- No system-wide advocacy for USMS:
  - Unable to evaluate system priorities
  - The pace of innovation slows
  - Vital, but traditional, industries are underserved
  - Metrology and standards are a competitive tool internationally
  - U.S. economic security is threatened

…the solution

- To create, over time, a strong private-public partnership that
  - Roadmaps America's priority measurement needs on a regular basis
  - Reports to customers and stakeholders on the state of the USMS
  - Encourages solutions to identified problems

What is NIST going to do?

- Define the *template* for data collection
- Work with other organizations to
  - Develop and collect *input*
  - Conduct sectoral and cross-sectoral *assessments*
  - Create an action-plan *roadmap*
- *Report* to customers and stakeholders on the state of the USMS
- Repeat the process

What can stakeholders do?

- Document and provide measurement system needs, solutions and providers
- Develop and collect input from workshops and other collaborative events:
  - Develop industry-specific metrology roadmaps
  - Coordinate industry solutions to identified needs
- Report on progress and plans to NIST and others
- Repeat the process

NIST's USMS Action Plan

- Assessment: Collect and analyze the status-quo
  - What are we doing now and how well?
  - Where do we need new solutions?
- Analysis: Identify cross-cutting needs and needs with no apparent solutions forthcoming.
- Dialog: Discuss the assessment and its significance with other solution providers
- Prioritize: In consultation with others, identify the solutions that will be pursued.
- Roadmap: Document and disseminate the go-forward action plan
- Repeat

Step 1 - Assessment: Identification

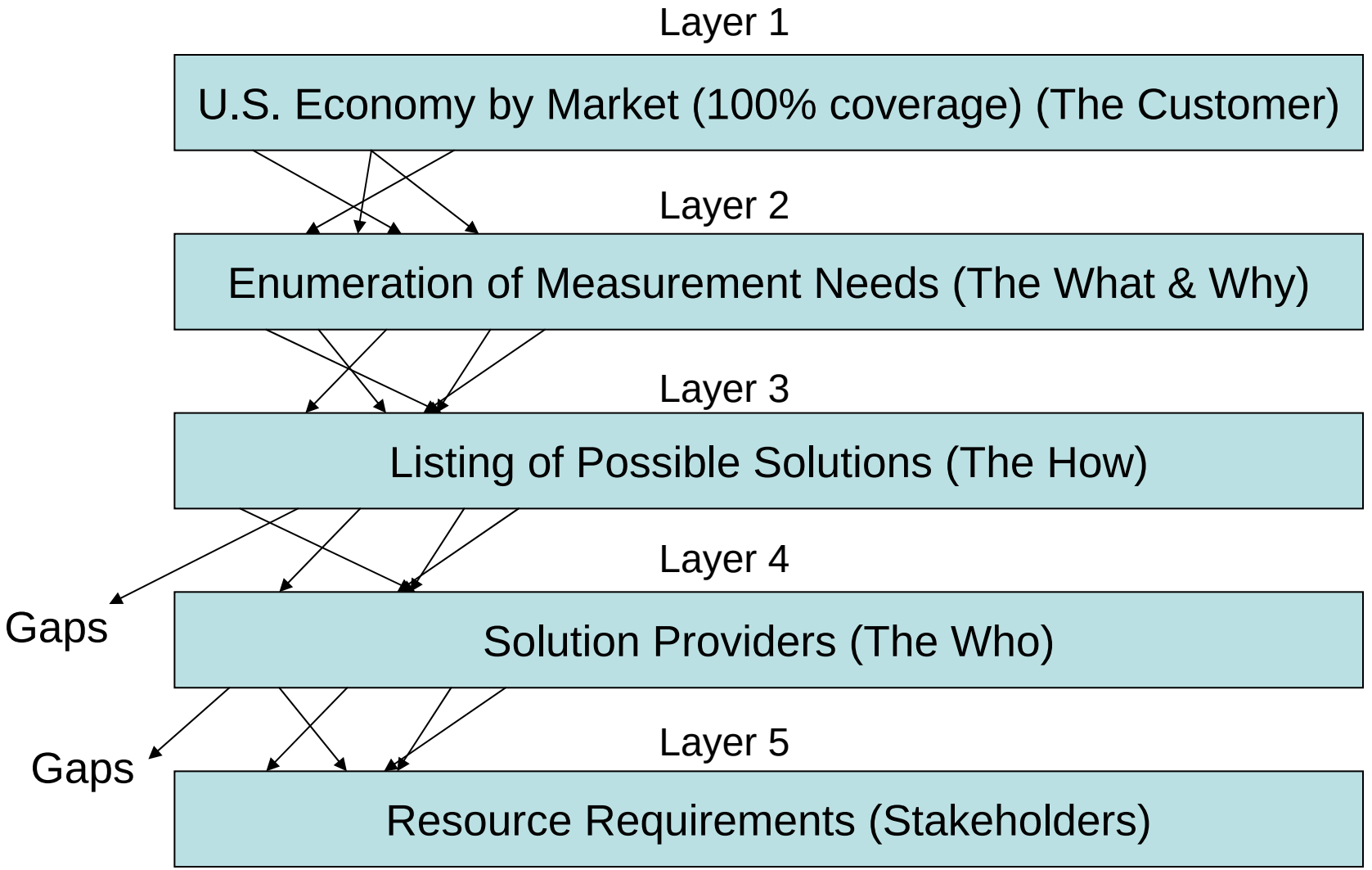
- Identify the most important measurement-related issues facing an economic sector or cutting across multiple sectors
  - Current and future needs of the entire U.S. economy (a big, long-term task)
  - All measurement needs, not just those best addressed by NIST

Step 2 – Assessment: Analysis

Map into the Measurement Needs Database, then:

- Create associations *within* layers
- Identify gaps
- View by sector
- View across sectors
- View by type of measurement need
- View by value proposition
- View by estimated importance/impact
- View by type of solution
- View by type of solution provider
- Etc.

USMS Database: Conceptual Model



USMS Measurement Needs Database

- Under development, based on conceptual model
  - Will be iterative process
    - Multiple versions between now and spring 2006
  - Will be ongoing enterprise
    - Eventual one-stop shopping for needs
- Will allow multiple taxonomies in different layers
- Will include both met and un-met needs
- Will provide basis for assessment of the USMS

Types of measurement needs …

1. New or improved measurement capabilities
   - New to the world measurements
   - Cost or performance improvements
2. New or improved measurement-related services and support, e.g.,
   - Traceability to recognized measurement standards
   - Confidence in the competence of laboratories to perform certain measurements or tests
   - Greater uniformity in measurement results from different laboratories
   - Greater acceptance of measurement results by specifiers
3. New or improved USMS stakeholder coordination.

Basic USMS Contribution Template

- What is the *measurement need*?
- How important is this?
- Who are the end-users?
- What are the possible solutions?
- Who might provide these solutions?
- What resources are required?

Sources of Input

- Analysis of existing roadmaps and workshop reports
  - NIST Industry and Technology Roadmaps and Workshop Reports Database, currently containing 300 documents
- USMS events
  - Topical USMS workshops
    - First round of NIST-sponsored USMS workshops
  - Meetings with a higher-level focus
    - USMS meetings dealing with system-wide questions
  - Could be organized by NIST or others
- USMS analysis by economic sector
- Economic studies
- Technologists from NIST, universities and industry

Involved entities and institutions …

- NIST
- Universities and other research institutions
- Calibration and testing labs
- Proficiency-testing providers
- Accreditation bodies
- Recognition authorities
- Standards developing organizations
- Product certifiers
- Instrument manufacturers
- State weights and measures programs
- Other national measurement institutes
- Etc.

Initial Set of NIST Workshops

- **Biophotonic Tools for Cell and Tissue Diagnostics**
- **Flexible, Large-Area Electronics and Photonics**
- **Improved Antibody-Based Metrology**
- **Measurement Challenges in Proteomics**
- **Medical Imaging Metrology in Telemedicine**
- **Metrology and Monitoring Technologies for the National Physical Infrastructure**
- **Metrology for the Magnetic Data Storage Industry**
- **Metrology Needs for Micro/Nano System Technologies**
- **Metrology Supporting Broadband Telecommunications Access and Transport**
- **Nano-Biotechnology**
- **Ultraviolet Radiation Metrology**

Step 3 - Roadmap

- Identify cross-sectoral (common) measurement needs
- Identify actual and proposed technical solutions, costs and timelines.
- Assess the economic significance of identified shortfalls.
- Identify potential solution providers and determine their intentions

Step 4 - Reporting: USMS Roadmap

I. Executive Summary

II. Why Measurements Are Important

III. Roadmapping Process

IV. Needs Assessment
- Sections on different sectors
- Section on cross-cutting needs

V. Plan for Responding

VI. Outstanding Issues

Timetable

- Publish first assessment – July 2006
- Develop NIST response – December 2006
- Begin reporting to USMS customers and stakeholders – January 2007

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